4.037 Paper No T2-82

LEGACY OF HYDRA TE RIDGE: AN ILLUS TRATED ACCOUNT

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Initially known as one of a series of accretionary thrust ridges along the Cascadia margin, this site has the distinction of hosting the first documented subduction-driven methane and fluid seep system (Kulm et al, 1986) that support prolific chemosynthetic fauna (Suess et al, 1985) as well as the most widely researched methane hydrate setting at an active margin (Suess et al, 1999). The name Hydrate Ridge, approved by the Unites States Board on Geographic Names in 1989, was proposed G. Bohrmann. Today Hydrate Ridge is a component of the Northeast Pacific Regional network of nodes that constitute the most advanced cabled observatory, the NSF-Ocean Observatory Initiative.

The illustrated account documents highlights of field studies, persons involved and key publications from the early years with submersible and ROV-deployments, deep drilling operations and expeditions by surface ships, each of which addressed for the first time objectives of gas hydrate research that still persist today. The account continues by illustrating the OOI strategy at the Hydrate Ridge nodes for the next decade to understand "how do tectonic, oceanographic and biologic processes modulate the flux of carbon into and out of submarine gas hydrate formations
(i.e., the gas hydrate capacitor)?" (OOI Science Prospectus, Oct. 2007).

Results of a few of the scientific highlights of work done at Hydrate Ridge having a strong impact are illustrated with no particular ranking: The marine microbial consortium mediating anaerobic methane oxidation AOM (Boetius et al 2000); the sulfate-methane-transition setting hosting macroscopic bio-films that increase methane turnover by AOM (Briggs et al 2011); the multiple autoclave corer that allowed CT-imaging of sediment-hydrate fabric under in situ pressure and temperatures (Abegg et al 2008), the recognition of bubble-fabric as resulting from hydrate formation under free gas (Suess et al 2002); the deployment of in situ Raman spectroscopy to measure hydrate properties (Hester et al 2007); the characterization of appearance and preservation of natural gas hydrates by X-ray diffraction (XRD) and cryo-scanning-electron-microscopy (cryo-SEM) techniques (Bohrmann et al 2007); the determination of crystal size of natural hydrates by high energy synchroton radiation (Klapp et al 2007); the

high-resolution U/Th dating of methane-derived authigenic carbonates (Teichert et al 2005); the miniaturized biosignature analysis that further characterizes the conditions of formation of these carbonates (Leefmann et al 2008); the mechanics of intermittent methane venting as inferred from 4-D seismic survey (Bangs et al 2011; Kannberg et al 2013); the combination of controlled source electromagnetic (CSEM) with magnetotelluric methods (MT) to detect and quantify gas hydrates in marine sediments (Weitemeyer et al 2005; 2011).

The scientific legacy of Hydrate Ridge resulted from proposal-driven basic research by largely academic institutions. The results sparked new insights and contributed --albeit by no means exclusively-- to an evolving view from pursuing hydrate reserves to documenting natural hydrate destabilization. The concern over environmental issue has raised the hotly issue referred to as "Arctic Armageddon". Less sensational but equally profound scientific spin-offs that may be traced back to results from Hydrate Ridge are research on the deep biosphere, carbon capture and storage, ocean acidification and in no small part gas hydrate exploitation as energy resource currently underway world wide (Bosswell and Collett 2011; Collett 2002).